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Certified by



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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)					
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<input type="checkbox"/> Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (280 characters max)					
UV STABILIZING ADDITIVE COMPOSITION					
Direct all correspondence to: CORRESPONDENCE ADDRESS					
<input type="checkbox"/> Customer Number				Place Customer Number Bar Code Label here	
OR Type Customer Number here					
<input checked="" type="checkbox"/> Firm or Individual Name		Cytac Industries Inc.			
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ENCLOSED APPLICATION PARTS (check all that apply)					
<input checked="" type="checkbox"/> Specification		Number of Pages		15	<input type="checkbox"/> CD(s), Number
<input type="checkbox"/> Drawing(s)		Number of Sheets			<input type="checkbox"/> Other (specify)
<input type="checkbox"/> Application Data Sheet		See 37 CFR 1.76			
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)					
<input type="checkbox"/> A check or money order is enclosed to cover the filing fees				FILING FEE AMOUNT (\$)	
<input checked="" type="checkbox"/> The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number		03-4083		\$160.00	
<input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.					
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
<input checked="" type="checkbox"/> No.					
<input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are:					

Respectfully submitted,

SIGNATURE

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Date

11/04/2003

REGISTRATION NO.

42,700

(if appropriate)

Docket Number:

03048-00

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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P19LARGE/REV05

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)			Docket No.
Applicant(s): Malatesta et al.			03048-00
Serial No. Not Yet Known	Filing Date Herewith	Examiner Not Yet Known	Group Art Unit Not Yet Known

Invention: UV STABILIZING ADDITIVE COMPOSITION

I hereby certify that the following correspondence:

Provisional Application for Patent Cover Sheet; Specification (15 pages); Return Postcard

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UV STABILIZING ADDITIVE COMPOSITION

FIELD OF THE INVENTION

5 This invention relates to an improved UV stabilizing additive composition. More specifically, this invention relates to an UV stabilizing additive composition comprising an ortho-hydroxy triazine compound, a hindered amine compound and hydroxybenzophenone compound.

BACKGROUND OF THE INVENTION

10 Exposure to sunlight and other sources of ultraviolet (UV) radiation is known to cause degradation of a wide variety of materials, especially polymeric materials. For example, polymeric materials such as plastics often discolor, lose gloss and/or become brittle as a result of prolonged exposure to UV light due primarily to a reduction in the molecular weight of
15 the polymer. Accordingly, a large body of art has been developed directed towards materials such as UV light absorbers and stabilizers, which are capable of inhibiting such degradation in polymeric articles.

 The present inventors have found that a combination of ortho-hydroxy triazine compound, a hindered amine compound and hydroxybenzophenone compound provides
20 synergistic protection of materials against UV light. This combination either provides better protection at typical UV stabilizer loading levels, or typical protection at much lower loading levels resulting in significant cost savings over prior art UV stabilizing additive compositions.

SUMMARY OF THE INVENTION

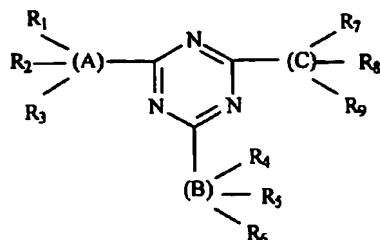
25 This invention relates to an UV stabilizing additive composition comprising an ortho-hydroxy triazine compound, a hindered amine compound and a hydroxybenzophenone
30 compound. This additive composition may be used to stabilize materials from UV radiation. This invention also contemplates a method of stabilizing a material by contacting the material with the UV stabilizing additive composition.

DETAILED DESCRIPTION OF THE INVENTION

35 This invention relates to an UV stabilizing additive composition comprising an ortho-hydroxy triazine compound, a hindered amine light stabilizing (HALS) compound and a hydroxybenzophenone compound.

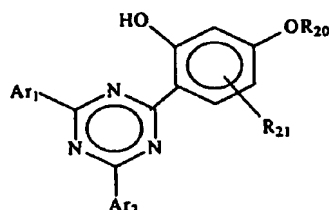
Preferably, the ortho-hydroxy tris-aryl-s-triazine compound has the following formula

I:



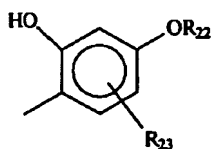
where A, B and C are each aromatic, at least one of A, B and C is substituted by a hydroxy group ortho to the point of attachment to the triazine ring, and each of R₁ through R₉ is selected from the group consisting of hydrogen, hydroxy, alkyl, alkoxy, sulfonic, carboxy, halo, haloalkyl and acylamino having from about 1 to about 24 carbon atoms.

One embodiment of the tris-aryl-s-triazine is a compound having the formula II:



where Ar₁ and Ar₂ are the same or different and are substituted or unsubstituted aryl groups; and where R₂₀ and R₂₁ are each independently a hydrogen, C₁-C₂₄ alkyl, C₁-C₂₄ haloalkyl, C₆-C₂₄ aryl, C₂-C₂₄ alkenyl, C₁-C₂₄ acyl, C₁-C₂₄ cycloalkyl, C₅-C₂₄ cycloacyl, C₇-C₂₄ aralkyl, or C₆-C₂₄ aracyl, substituted or unsubstituted biphenylene, substituted or unsubstituted naphthalene, OR, NRR', CONRR', OCOR, CN, SR, SO₂R, and where R and R' are each independently a hydrogen, C₁-C₂₄ alkyl, C₁-C₂₄ haloalkyl, C₆-C₂₄ aryl, C₂-C₂₄ alkenyl, C₁-C₂₄ acyl, C₁-C₂₄ cycloalkyl, C₅-C₂₄ cycloacyl, C₇-C₂₄ aralkyl, or C₆-C₂₄ aracyl, substituted or unsubstituted biphenylene, or substituted or unsubstituted naphthalene.

Preferably, in the above formula II, Ar₁ has the formula IIa:

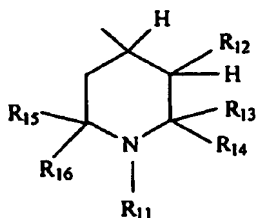


where R₂₂ and R₂₃ are each independently a hydrogen, C₁-C₂₄ alkyl, C₁-C₂₄ haloalkyl, C₆-C₂₄ aryl, C₂-C₂₄ alkenyl, C₁-C₂₄ acyl, C₁-C₂₄ cycloalkyl, C₅-C₂₄ cycloacyl, C₇-C₂₄ aralkyl, or C₆-C₂₄ aracyl, substituted or unsubstituted biphenylene, substituted or unsubstituted naphthalene, OR, NRR', CONRR', OCOR, CN, SR, and SO₂R, and where R and R' are as defined above.

Also preferred in the above formula II is when R_{20} is hydrogen or a C_1 - C_8 alkyl, R_{21} is hydrogen and Ar_1 and Ar_2 may be the same or different and are benzyl, methylbenzyl, or dimethylbenzyl.

Examples of suitable tris-aryl-s-triazines that may be used are 2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-n-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-(mixed iso-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-tridecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-butyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-octyloxypropyloxy)-phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[4-dodecyloxy/tridecyloxy-2-hydroxypropoxy)-2-hydroxyphenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-dodecyloxypropoxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine; 2-(2-hydroxy-4-methoxyphenyl)-4,6-diphenyl-1,3,5-triazine; 2,4,6-tris[2-hydroxy-4-(3-butoxy-2-hydroxypropoxy)phenyl]-1,3,5-triazine and 2-(2-hydroxyphenyl)-4-(4-methoxyphenyl)-6-phenyl-1,3,5-triazine.

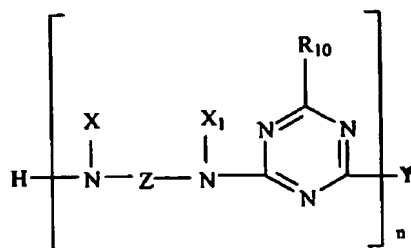
The hindered amine compound may be any suitable hindered amine compound such as those containing a 2,2,6,6-tetraalkylpiperidine or 2,2,6,6-tetraalkylpiperazinone radical. One embodiment of a hindered amine compound is one that contains at least one group having the following formula III:



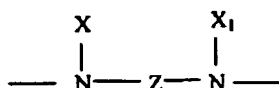
where R_{11} is hydrogen, O, OH, C_1 - C_{18} alkyl, $-CH_2CN$, C_1 - C_{18} alkoxy, C_1 - C_{18} hydroxyalkoxy, C_5 - C_{12} cycloalkoxy, C_5 - C_{12} hydrocycloalkoxy, C_3 - C_8 alkenyl, C_1 - C_{18} alkynyl, C_7 - C_9 phenylalkyl, unsubstituted or substituted on the phenyl with 1, 2 or 3 C_1 - C_4 alkyls, or an aliphatic C_1 - C_8 acyl; R_{12} is hydrogen, C_1 - C_8 alkyl, or benzyl; R_{13} , R_{14} , R_{15} , and R_{16} are each independently a C_1 - C_{18} alkyl, benzyl or phenethyl, or optionally R_{13} and R_{14} , and/or R_{15} and R_{16} , taken together with the carbon which they are attached, form a C_5 - C_{10} cycloalkyl.

Another embodiment of a hindered amine compound is a compound that has formula IV below:

5



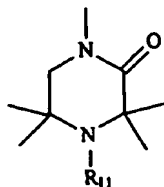
- 10 where R_{10} is a morpholino, C_1 - C_8 alkylamine, di(C_1 - C_8) alkylamine, pyrrolidyl, cyclohexylamine or combinations thereof,
 X and X_1 , which may be the same or different, and are hydrogen, C_1 - C_{20} alkyl, or a radical of formula III defined above,
 R_{11} to R_{16} are as defined above,
 15 Z is a straight chained or branched C_1 - C_{20} alkylene or a straight chained or branched C_1 - C_{20} alkalene chain interrupted by at least oxy, thio, or $-N(R_{17})-$, where R_{17} is hydrogen, C_1 - C_{20} alkyl, C_5 - C_{10} cycloalkylene C_6 - C_{12} arylene, C_8 - C_{14} aralkylene or the radical of formula III;
 n is an integer greater than 1;
 20 and Y is a halogen atom, C_1 - C_8 alkylamine, di(C_1 - C_8) alkylamine, pyrrolidyl, morpholino, cyclohexylamine, or



- 25 where X, X_1 , and Z are as previously defined.

Preferably in the above formula IV, Z is a C_2 to C_6 alkylene, R_{10} is a morpholino or cyclohexylamine, X and X_1 is the radical of formula III, R_{11} is hydrogen or methyl, R_{12} is hydrogen, and R_{13} , R_{14} , R_{15} and R_{16} are methyl.

- Another embodiment of a hindered amine is a 2,2,6,6-tetraalkylpiperazinone. One
 30 embodiment of a 2,2,6,6-tetraalkylpiperazinone compound is one that contains at least one group of formula IVa:



35

where R_{11} is as defined above.

Examples of suitable hindered amine compounds include, but are not limited to:

1H-Pyrrole-2,5-dione, 1-octadecyl-, polymer with (1-methylethenyl)benzene and 1-(2,2,6,6-tetramethyl-4-piperidiny)-1H-pyrrole-2,5-dione; piperazinone, 1,1',1''-[1,3,5-triazine-2,4,6-triyltris[(cyclohexylimino)-2,1-ethanediyl]]tris[3,3,5,5-tetramethyl-]; piperazinone, 1,1',1''-[1,3,5-triazine-2,4,6-triyltris[(cyclohexylimino)-2,1-ethanediyl]]tris[3,3,4,5,5-pentamethyl-];

5 the reaction product of 7,7,9,9-tetramethyl-2-cycloundecyl-1-oxa-3,8-diaza-4-oxospiro[4.5]decane and epichlorohydrin; the condensate of N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)hexamethylenediamine and 4-cyclohexylamino-2,6-dichloro-1,3,5-triazine; the condensate of 1,2-bis(3-aminopropylamino)ethane; 2,4,6-trichloro-1,3,5-triazine

10 and 4-butylamino-2,2,6,6-tetramethylpiperidine; the condensate of N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)hexamethylenediamine and 4-morpholino-2,6-dichloro-1,3,5-triazine; the condensate of 2-chloro-4,6-bis(4-n-butylamino-2,2,6,6-tetramethylpiperidyl)-1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane; the condensate of 2-chloro-4,6-bis(4-n-butylamino-1,2,2,6,6-pentamethylpiperidyl)-1,3,5-triazine and 1,2-bis-(3-

15 aminopropylamino)ethane; 2-[(2-hydroxyethyl)amino]-4,6-bis[N-(1-cyclohexyloxy-2,2,6,6-tetramethylpiperidin-4-yl)butylamino]-1,3,5-triazine; propanedioic acid, [(4-methoxyphenyl)-methylene]-bis-(1,2,2,6,6-pentamethyl-4-piperidiny) ester; tetrakis(2,2,6,6-tetramethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, 1-[2-[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-

20 oxopropoxy]ethyl]-2,2,6,6-tetramethyl-4-piperidiny ester; N-(1-octyloxy-2,2,6,6-tetramethylpiperidin-4-yl)-N'-dodecyloxalamide; tris(2,2,6,6-tetramethylpiperidin-4-yl)nitritotriacetate; 1,5-dioxaspiro[5,5]undecane-3,3-dicarboxylic acid, bis(1,2,2,6,6-pentamethyl-4-piperidiny); 1,5-dioxaspiro[5,5]undecane-3,3-dicarboxylic acid, bis(2,2,6,6-tetramethyl-4-piperidiny); the condensate of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-

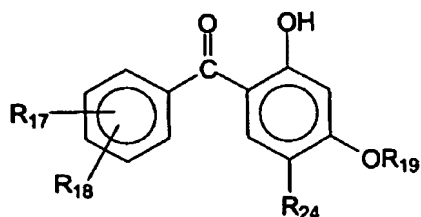
25 hydroxypiperidine and succinic acid; the condensate of N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)hexamethylenediamine and 4-tert-octylamino-2,6-dichloro-1,3,5-triazine; 1,2,3,4-butanetetracarboxylic acid, 1,2,2,6,6-pentamethyl-4-piperidiny tridecyl ester; tetrakis(2,2,6,6-tetramethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; 1,2,3,4-butanetetracarboxylic acid, 2,2,6,6-tetramethyl-4-piperidiny tridecyl ester; tetrakis(1,2,2,6,6-pentamethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; mixture of 2,2,4,4-tetramethyl-

30 21-oxo-7-oxa-3,20-diazaspiro(5.1.11.2)-heneicosane-20-propanoic acid-dodecylester; 2,2,4,4-tetramethyl-21-oxo-7-oxa-3,20-diazaspiro(5.1.11.2)-heneicosane-20-propanoic acid-tetradecylester; 1H,4H,5H,8H-2,3a,4a,6,7a,8a-hexaazacyclopenta[def]fluorene-4,8-dione, hexahydro-2,6-bis(2,2,6,6-tetramethyl-4-piperidiny)-; polymethyl[propyl-3-oxy(2',2',6',6'-

35 tetramethyl-4,4'-piperidiny)]siloxane; polymethyl[propyl-3-oxy(1',2',2',6',6'-pentamethyl-4,4'-piperidiny)]siloxane; copolymer of methylmethacrylate with ethyl acrylate and 2,2,6,6-

tetramethylpiperidin-4-yl acrylate; copolymer of mixed C₂₀ to C₂₄ alpha-olefins and (2,2,6,6-tetramethylpiperidin-4-yl)succinimide; 1,2,3,4-butanetetracarboxylic acid, polymer with β,β,β',β'-tetramethyl-2,4,8,10-tetraoxaspiro[5.5]undecane-3,9-diethanol, 1,2,2,6,6-pentamethyl-4-piperidiny ester; 1,2,3,4-butanetetracarboxylic acid, polymer with β,β,β',β'-tetramethyl-2,4,8,10-tetraoxaspiro[5.5]undecane-3,9-diethanol, 2,2,6,6-tetramethyl-4-piperidiny ester copolymer; 1,3-benzenedicarboxamide, N,N'-bis(2,2,6,6-tetramethyl-4-piperidiny); 1,1'-(1,10-dioxo-1,10-decanediyl)-bis(hexahydro-2,2,4,4,6-pentamethylpyrimidine; ethane diamide, N-(1-acetyl-2,2,6,6-tetramethylpiperidiny)-N'-dodecyl; formamide, N,N'-1,6-hexanediylbis[N-(2,2,6,6-tetramethyl-4-piperidiny)]; D-glucitol, 1,3:2,4-bis-O-(2,2,6,6-tetramethyl-4-piperidinyldene)-; 2,2,4,4-tetramethyl-7-oxa-3,20-diaza-21-oxo-dispiro[5.1.11.2]heneicosane; propanamide, 2-methyl-N-(2,2,6,6-tetramethyl-4-piperidiny)-2-[(2,2,6,6-tetramethyl-4-piperidiny)amino]-; 7-oxa-3,20-diazadispiro[5.1.11.2]heneicosane-20-propanoic acid, 2,2,4,4-tetramethyl-21-oxo-, dodecyl ester; N-(2,2,6,6-tetramethylpiperidin-4-yl)-β-aminopropionic acid dodecyl ester; N-(2,2,6,6-tetramethylpiperidin-4-yl)-N'-aminooxalamide; propanamide, N-(2,2,6,6-tetramethyl-4-piperidiny)-3-[(2,2,6,6-tetramethyl-4-piperidiny)amino]-; mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine; 3-dodecyl-1-(1,2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; 3-dodecyl-1-(1-ethanoyl-2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; bis(2,2,6,6-tetramethylpiperidin-4-yl)succinate; bis(1,2,2,6,6-pentamethylpiperidin-4-yl) n-butyl 3,5-di-tert-butyl-4-hydroxybenzylmalonate; tris(2,2,6,6-tetramethylpiperidin-4-yl) nitrilotriacetate; 1,1'-(1,2-ethanediyl)bis(3,3,5,5-tetramethylpiperazinone); 4-benzoyl-2,2,6,6-tetramethylpiperidine; 4-stearyloxy-2,2,6,6-tetramethylpiperidine; bis(1,2,2,6,6-pentamethylpiperidyl)-2-n-butyl-2-(2-hydroxy-3,5-di-tert-butylbenzyl)malonate; 3-n-octyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decan-2,4-dione; bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)sebacate; bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)succinate; 8-acetyl-3-dodecyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decan-2,4-dione; 3-dodecyl-1-(2,2,6,6-tetramethylpiperidin-4-yl)pyrrolidin-2,5-dione; 3-dodecyl-1-(1-ethanoyl-2,2,6,6-tetramethylpiperidin-4-yl)pyrrolidin-2,5-dione; 3-dodecyl-1-(1,2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; a mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine; 2-undecyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxospiro[4.5]decan; 1,5-dioxaspiro[5.5]undecane-3,3-dicarboxylic acid, bis(2,2,6,6-tetramethyl-4-piperidiny) and 1,5-dioxaspiro[5.5]undecane-3,3-dicarboxylic acid, bis(1,2,2,6,6-pentamethyl-4-piperidiny).

The hydroxybenzophenone compound of the present invention may be any suitable hindered hydroxybenzoate compound such as those having the formula V:



where R_{17} , R_{18} and R_{24} are each independently hydrogen alkyl, aryl, aralkyl, alkaryl, alkoxy, aryloxy having from 1 to 18 carbon atoms and R_{19} is hydrogen, a C_1 - C_{24} alkyl, or substituted or unsubstituted C_6 - C_{24} aryl. Preferably, R_{17} , R_{18} and R_{24} are each hydrogen and R_{19} is a C_1 - C_8 alkyl.

Examples of suitable hindered hydroxybenzophenone compounds include:

2,4-dihydroxybenzophenone; 2-hydroxy-4-methoxybenzophenone; 2-hydroxy-4-octyloxybenzophenone; 2-hydroxy-4-decyloxybenzophenone; 2-hydroxy-4-dodecyloxybenzophenone; 2-hydroxy-4-benzyloxybenzophenone; 2,2'-dihydroxy-4,4'-dimethoxybenzophenone; 2,2',4,4'-tetrahydroxybenzophenone; 2,4-dihydroxy-4'-tert-butylbenzophenone; 1,6-bis-(3-hydroxy-4-benzoylphenoxy)hexane; methylenebis-(2-benzoyl-5-methoxyphenol).

In one embodiment of the present invention, the UV stabilizing additive composition of the present invention may be employed to stabilize materials which are subject to degradation by ultraviolet radiation by contacting the UV stabilizing additive composition with a composition comprising polymeric or other materials, either chemically or physically. Non-limiting examples of materials that may be so stabilized are polyolefins, polyesters, polyethers, polyketones, polyamides, natural and synthetic rubbers, polyurethanes, polystyrenes, high-impact polystyrenes, polyacrylates, polymethacrylates, polyacetals, polyacrylonitriles, polybutadienes, polystyrenes, acrylonitrile-butadiene-styrene, styrene acrylonitrile, acrylate styrene acrylonitrile, cellulosic acetate butyrate, cellulosic polymers, polyimides, polyamideimides, polyetherimides, polyphenylsulfides, polyphenyloxide, polysulfones, polyethersulfones, polyvinylchlorides, polycarbonates, polyketones, aliphatic polyketones, thermoplastic olefins, aminoresin cross-linked polyacrylates and polyesters, polyisocyanate cross-linked polyesters and polyacrylates, phenol/formaldehyde, urea/formaldehyde and melamine/formaldehyde resins, drying and non-drying alkyd resins, alkyd resins, polyester resins, acrylate resins cross-linked with melamine resins, urea resins, isocyanates, isocyanurates, carbamates, and epoxy resins, cross-linked epoxy resins

derived from aliphatic, cycloaliphatic, heterocyclic and aromatic glycidyl compounds, which are cross-linked with anhydrides or amines, polysiloxanes, Michael addition polymers, amines, blocked amines with activated unsaturated and methylene compounds, ketimines with activated unsaturated and methylene compounds, polyketimines in combination with unsaturated acrylic polyacetoacetate resins, polyketimines in combination with unsaturated acrylic resins, radiation curable compositions, epoxymelamine resins, organic dyes, cosmetic products, cellulose-based paper formulations, photographic film paper, fibers, waxes, inks, and blends thereof.

Preferably, the materials to be stabilized are thermoplastic olefins, acrylonitrile-butadiene-styrene, polyesters, polyvinylchloride, polyamides, polyurethanes, or homo- and copolymers of propylene, isobutylene, butene, methylpentene, hexene, heptene, octene, isoprene, butadiene, hexadiene, dicyclopentadiene, ethylidene cyclopentene and norbornene. More preferably, the materials are polypropylene and thermoplastic olefins.

The amount of the triazine compound used in the material to be stabilized using the combination of additives of the present invention is typically lower than normal usage. The lower limit of the amount of triazine may be as low as about 10 ppm, or about 20 ppm, or about 50 ppm or about 75 ppm or about 100 ppm or about 200 ppm, based on the amount of material to be stabilized. There is no upper limit to the amount of triazine, but it would be about 5000 ppm or about 4000 ppm or about 3000 ppm or about 2000 ppm or about 1000 ppm or about 500 ppm, based on the material to be stabilized.

The amount of the hydroxybenzophenone compound used in the material to be stabilized using the combination of additives of the present invention is also typically lower than normal usage. The lower limit of the amount of hydroxybenzophenone may be as low as about 10 ppm, or about 20 ppm, or about 50 ppm or about 75 ppm or about 100 ppm or about 200 ppm, or about 500 ppm, based on the amount of material to be stabilized. There is no upper limit to the amount of hydroxybenzophenone, but it would be about 5000 ppm or about 4000 ppm or about 3000 ppm or about 2000 ppm or about 1000 ppm or about 500 ppm, based on the material to be stabilized.

The amount of the hindered amine compound used in the material to be stabilized using the combination of additives of the present invention is more or less its typically amount. The lower limit of the amount of hindered amine compound may be about 250 ppm, or about 500 ppm, or about 1000 ppm or about 2000 ppm, based on the amount of material to be stabilized. There is no upper limit to the amount of hindered amine compound, but it would be about 30000 ppm, or about 20000 ppm or about 15000 ppm or about 12500 ppm or about 10000 ppm or about 7500 ppm, or about 5000 ppm, based on the material to be stabilized.

The amount of hindered amine compound with respect to the other UV absorbers is typically greater. The ratio of hindered amine compound to the triazine UV absorber may be as high as about 50:1, or about 25:1, or about 20:1 or about 10:1, or about 7:1 or about 3:1. The ratio of hindered amine compound to the hydroxybenzophenone UV absorber may be about 25:1, or about 20:1 or about 10:1, or about 7:1 or about 3:1 or about 2:1 or about 1.5:1. The ratio of hydroxybenzophenone compound to the triazine UV absorber may be about 10:1, or about 5:1, or about 3:1 or about 2:1, or about 1:1 or about 1:2.

It should be noted that the amounts and ratios disclosed for the above additives are each independent of each other.

This invention contemplates that a benzotriazole UV absorber may be substituted for the hydroxybenzophenone UV absorber. The benzotriazole compound may also be added to the other three additives. The same ratios and amounts disclosed above for the hydroxybenzophenone UV absorber may be used for the benzotriazole UV absorber. The following are examples of benzotriazole UV absorbers: 2-(2-hydroxy-5-methylphenyl)-benzotriazole; 2-(2-hydroxy-5-tert-butylphenyl)-benzotriazole; 2-(2-hydroxy-3,5-di-tert-butylphenyl)-benzotriazole; 5-chloro-2-(2-hydroxy-3-tert-butyl-5-methylphenyl)-benzotriazole; 5-chloro-2-(2-hydroxy-3,5-di-tert-butyl-5-methylphenyl)-benzotriazole; 2-(2-hydroxy-3-tert-butyl-5-methylphenyl)-benzotriazole; 2-(2-hydroxy-3,5-di-tert-butyl-5-methylphenyl)-benzotriazole; 2-(2-hydroxy-3-sec-butyl-5-tert-butyl)-benzotriazole; 2-(2-hydroxy-4-octyloxy)-benzotriazole; 2-(2-hydroxy-5-tert-octyl)-benzotriazole; 2-[2-hydroxy-3,5-di(α,α -dimethylbenzyl)phenyl]-benzotriazole; 2-(2-hydroxy-3-dodecyl-5-methylphenyl)benzotriazole; 2-[2-hydroxy-3-(α,α' -dimethylbenzyl)-5-(1,1,3,3-tetramethylbutyl)phenyl]benzotriazole; 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-benzotriazol-2-ylphenol]; 2,[2-hydroxy-3-(3,4,5,6-tetrahydrophthalimidomethyl)-5-methylphenyl]benzotriazole; 2-[3-tert-butyl-5-(2-(2-ethylhexyloxycarbonyl)ethyl)-2-hydroxyphenyl]benzotriazole; a mixture of transesterification products of 2-[(3-tert-butyl-5-(2-methoxycarbonyl)ethyl)-2-hydroxyphenyl]benzotriazole with polyethylene glycol of about MW 300; 5-chloro-2-[2-hydroxy-3-tert-butyl-5-(2-octyloxycarbonyl)ethylphenyl]benzotriazole.

This invention also contemplates a method of preparing the compositions above by contacting the UV stabilizing additive composition with the material to be stabilized. The material to be stabilized and UV stabilizing additive composition are contacted by preferably blending or compounding the components in a kneading apparatus such as a single or twin screw extruder, Banbury mixer, or hot rollers. The processing parameters and the use of such kneading apparatuses are well known to those skilled in the art.

As would be apparent to those skilled in the art of making plastic materials, in addition to the material to be stabilized and UV stabilizing additive composition, the

composition of the present invention may include conventional additives including but are not limited to, antioxidants, metal deactivators, hydroxylamines, nitrones, lactones, co-stabilizers, nucleating agents, clarifying agents, neutralizers, metallic stearates, metal oxides, hydrotalcites, fillers and reinforcing agents, plasticizers, lubricants, emulsifiers, pigments, rheological additives, catalysts, level agents, optical brighteners, flame retardant agents, anti-static agents and blowing agents.

The UV stabilizing additive composition and the material to be stabilized may be used to make articles, such as an extruded or molded articles, coatings, tapes and films. The articles may be formed by extrusion, sheet extrusion, injection molding, blow molding, injection blow molding, rotational or roto-molding, calendaring, thermoforming, compression molding, vacuum molding, pressure molding, reaction injection molding, and other similar techniques known in the art. In addition, coatings may be applied by powder coating, extrusion coating, electrocoating, spraying, dipping, and other similar techniques known in the art.

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What is claimed is:

1. A composition comprising an UV stabilizing composition comprising:
 - (i) an ortho-hydroxy tris-aryl-s-triazine compound;
 - 5 (ii) a hindered amine compound; and
 - (iii) a hydroxybenzophenone compound.
2. A composition comprising an UV stabilizing composition comprising:
 - (i) an ortho-hydroxy tris-aryl-s-triazine compound;
 - 10 (ii) a hindered amine compound; and
 - (iii) a hydroxybenzophenone compoundwhere the ratio of the hindered amine compound to the triazine compound is about 3:1 to about 25:1; and the ratio of the hindered amine compound to the hydroxybenzophenone compound is about 2:1 to 10:1
3. The composition of claim 2 further comprising a material to be stabilized.
4. The composition of claim 3 wherein the amount of the triazine compound is about 20 ppm to about 2000 ppm, the amount of the hydroxybenzophenone is about 20 ppm to about 5000 ppm and the amount of the hindered amine is about 250 ppm to about 20000 ppm, all based on the weight of the material to be stabilized.
5. The composition of claim 3, wherein said material to be stabilized is selected from the group consisting of: polyolefins, polyesters, polyethers, polyketones, polyamides, natural and synthetic rubbers, polyurethanes, polystyrenes, high-impact polystyrenes, polyacrylates, polymethacrylates, polyacetals, polyacrylonitriles, polybutadienes, polystyrenes, acrylonitrile-butadiene-styrene, styrene acrylonitrile, acrylate styrene acrylonitrile, cellulosic acetate butyrate, cellulosic polymers, polyimides, polyamideimides, polyetherimides, polyphenylsulfides, polyphenyloxide, polysulfones, polyethersulfones, polyvinylchlorides, polycarbonates, polyketones, aliphatic polyketones, thermoplastic olefins, aminoresin cross-linked polyacrylates and polyesters, polyisocyanate cross-linked polyesters and polyacrylates, phenol/formaldehyde, urea/formaldehyde and melamine/formaldehyde resins, drying and non-drying alkyd resins, alkyd resins, polyester resins, acrylate resins cross-linked with melamine resins, urea resins, isocyanates, isocyanurates, carbamates, and epoxy resins, cross-linked epoxy resins derived from aliphatic, cycloaliphatic, heterocyclic and aromatic glycidyl

compounds, which are cross-linked with anhydrides or amines, polysiloxanes, Michael addition polymers, amines, blocked amines with activated unsaturated and methylene compounds, ketimines with activated unsaturated and methylene compounds, polyketimines in combination with unsaturated acrylic polyacetoacetate resins, polyketimines in combination with unsaturated acrylic resins, radiation curable compositions, epoxymelamine resins, organic dyes, cosmetic products, cellulose-based paper formulations, photographic film paper, fibers, waxes, inks, and blends thereof.

6. The composition of claim 2, wherein said triazine is selected from the group consisting of: 2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-n-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-(mixed iso-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-tridecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-butyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-octyloxypropyloxy)-phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[4-dodecyloxy/tridecyloxy-2-hydroxypropoxy]-2-hydroxyphenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-[2-hydroxy-4-(2-hydroxy-3-dodecyloxypropoxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine; 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine; 2-(2-hydroxy-4-methoxyphenyl)-4,6-diphenyl-1,3,5-triazine; 2,4,6-tris[2-hydroxy-4-(3-butoxy-2-hydroxypropoxy)phenyl]-1,3,5-triazine; 2-(2-hydroxyphenyl)-4-(4-methoxyphenyl)-6-phenyl-1,3,5-triazine and mixtures thereof.

7. The composition of claim 2, wherein said hindered amine compound is selected from the group consisting of: 1H-Pyrrole-2,5-dione, 1-octadecyl-, polymer with (1-methylethenyl)benzene and 1-(2,2,6,6-tetramethyl-4-piperidiny)-1H-pyrrole-2,5-dione; piperazinone, 1,1',1''-[1,3,5-triazine-2,4,6-triyltris((cyclohexylimino)-2,1-ethanediyl)]tris[3,3,5,5-tetramethyl-]; piperazinone, 1,1',1''-[1,3,5-triazine-2,4,6-triyltris((cyclohexylimino)-2,1-ethanediyl)]tris[3,3,4,5,5-pentamethyl-]; the reaction product of 7,7,9,9-tetramethyl-2-cycloundecyl-1-oxa-3,8-diaza-4-oxospiro[4.5]decane and epichlorohydrin; the condensate of N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)hexamethylenediamine and 4-cyclohexylamino-2,6-dichloro-1,3,5-triazine; the condensate of 1,2-bis(3-aminopropylamino)ethane, 2,4,6-trichloro-1,3,5-triazine and 4-butylamino-2,2,6,6-tetramethylpiperidine; the condensate of N,N'-bis(2,2,6,6-

tetramethylpiperidin-4-yl)hexamethylenediamine and 4-morpholino-2,6-dichloro-1,3,5-
 triazin ; the condensate of 2-chloro-4,6-bis(4-n-butylamino-2,2,6,6-tetramethylpiperidyl)-
 1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane; the condensate of 2-chloro-4,6-
 5 bis(4-n-butylamino-1,2,2,6,6-pentamethylpiperidyl)-1,3,5-triazine and 1,2-bis-(3-
 aminopropylamino)ethane; 2-[(2-hydroxyethyl)amino]-4,6-bis[N-(1-cyclohexyloxy-2,2,6,6-
 tetramethylpiperidin-4-yl)butylamino]-1,3,5-triazine; propanedioic acid, [(4-methoxyphenyl)-
 methylene]-bis-(1,2,2,6,6-pentamethyl-4-piperidinyl) ester; tetrakis(2,2,6,6-
 tetramethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; benzenepropanoic acid, 3,5-
 bis(1,1-dimethylethyl)-4-hydroxy-, 1-[2-[3-[3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl]-1-
 10 oxopropoxy]ethyl]-2,2,6,6-tetramethyl-4-piperidinyl ester; N-(1-octyloxy-2,2,6,6-
 tetramethylpiperidin-4-yl)-N'-dodecyloxamide; tris(2,2,6,6-tetramethylpiperidin-4-yl)
 nitrilotriacetate; 1,5-dioxaspiro[5,5]undecane-3,3-dicarboxylic acid, bis(1,2,2,6,6-
 pentamethyl-4-piperidinyl); 1,5-dioxaspiro[5,5]undecane-3,3-dicarboxylic acid, bis(2,2,6,6-
 tetramethyl-4-piperidinyl); the condensate of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-
 15 hydroxypiperidine and succinic acid; the condensate of N,N'-bis(2,2,6,6-
 tetramethylpiperidin-4-yl)hexamethylenediamine and 4-tert-octylamino-2,6-dichloro-1,3,5-
 triazine; 1,2,3,4-butanetetracarboxylic acid, 1,2,2,6,6-pentamethyl-4-piperidinyl tridecyl
 ester; tetrakis(2,2,6,6-tetramethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; 1,2,3,4-
 butanetetracarboxylic acid, 2,2,6,6-tetramethyl-4-piperidinyl tridecyl ester; tetrakis(1,2,2,6,6-
 20 pentamethylpiperidin-4-yl)-1,2,3,4-butanetetracarboxylate; mixture of 2,2,4,4-tetramethyl-
 21-oxo-7-oxa-3.20-diazaspiro(5.1.11.2)-heneicosane-20-propanoic acid-dodecylester;
 2,2,4,4-tetramethyl-21-oxo-7-oxa-3.20-diazaspiro(5.1.11.2)-heneicosane-20-propanoic acid-
 tetradecylester; 1H,4H,5H,8H-2,3a,4a,6,7a,8a-hexaazacyclopenta[def]fluorene-4,8-dione,
 hexahydro-2,6-bis(2,2,6,6-tetramethyl-4-piperidinyl)-; polymethyl[propyl-3-oxy(2',2',6',6'-
 25 tetramethyl-4,4'-piperidinyl)]siloxane; polymethyl[propyl-3-oxy(1',2',2',6',6'-pentamethyl-4,4'-
 piperidinyl)]siloxane; copolymer of methylmethacrylate with ethyl acrylate and 2,2,6,6-
 tetramethylpiperidin-4-yl acrylate; copolymer of mixed C₂₀ to C₂₄ alpha-olefins and (2,2,6,6-
 tetramethylpiperidin-4-yl)succinimide; 1,2,3,4-butanetetracarboxylic acid, polymer with
 β,β,β',β'-tetramethyl-2,4,8,10-tetraoxaspiro[5.5]undecane-3,9-diethanol, 1,2,2,6,6-
 30 pentamethyl-4-piperidinyl ester; 1,2,3,4-butanetetracarboxylic acid, polymer with β,β,β',β'-
 tetramethyl-2,4,8,10-tetraoxaspiro[5.5]undecane-3,9-diethanol, 2,2,6,6-tetramethyl-4-
 piperidinyl ester copolymer; 1,3-benzenedicarboxamide, N,N'-bis(2,2,6,6-tetramethyl-4-
 piperidinyl); 1,1'-(1,10-dioxo-1,10-decanediyl)-bis(hexahydro-2,2,4,4,6,6-
 pentamethylpyrimidine; ethane diamide, N-(1-acetyl-2,2,6,6-tetramethylpiperidinyl)-N'-
 35 dodecyl; formamide, N,N'-1,6-hexanedibis[N-(2,2,6,6-tetramethyl-4-piperidinyl)]; D-glucitol,
 1,3:2,4-bis-O-(2,2,6,6-tetramethyl-4-piperidinylidene)-; 2,2,4,4-tetramethyl-7-oxa-3,20-diaza-

- 21-oxo-dispiro[5.1.11.2]heneicosane; propanamide, 2-methyl-N-(2,2,6,6-tetramethyl-4-piperidiny)-2-[(2,2,6,6-tetramethyl-4-piperidiny)amino]-; 7-oxa-3,20-diazadispiro[5.1.11.2]heneicosane-20-propanoic acid, 2,2,4,4-tetramethyl-21-oxo-, dodecyl ester; N-(2,2,6,6-tetramethylpiperidin-4-yl)- β -aminopropionic acid dodecyl ester; N-(2,2,6,6-tetramethylpiperidin-4-yl)-N'-aminooxalamide; propanamide, N-(2,2,6,6-tetramethyl-4-piperidiny)-3-[(2,2,6,6-tetramethyl-4-piperidiny)amino]-; mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine; 3-dodecyl-1-(1,2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; 3-dodecyl-1-(1-ethanoyl-2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; bis(2,2,6,6-tetramethylpiperidin-4-yl)succinate; bis(1,2,2,6,6-pentamethylpiperidin-4-yl) n-butyl 3,5-di-tert-butyl-4-hydroxybenzylmalonate; tris(2,2,6,6-tetramethylpiperidin-4-yl) nitilotriacetate; 1,1'-(1,2-ethanediyl)bis(3,3,5,5-tetramethylpiperazinone); 4-benzoyl-2,2,6,6-tetramethylpiperidine; 4-stearyloxy-2,2,6,6-tetramethylpiperidine; bis(1,2,2,6,6-pentamethylpiperidyl)-2-n-butyl-2-(2-hydroxy-3,5-di-tert-butylbenzyl)malonate; 3-n-octyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decan-2,4-dione; bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)sebacate; bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)succinate; 8-acetyl-3-dodecyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decan-2,4-dione; 3-dodecyl-1-(2,2,6,6-tetramethylpiperidin-4-yl)pyrrolidine-2,5-dione; 3-dodecyl-1-(1-ethanoyl-2,2,6,6-tetramethylpiperidin-4-yl)pyrrolidine-2,5-dione; 3-dodecyl-1-(1,2,2,6,6-pentamethylpiperidin-4-yl)pyrrolidine-2,5-dione; a mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine; 2-undecyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxospiro[4.5]decan-2,4-dione; 1,5-dioxaspiro[5.5]undecane-3,3-dicarboxylic acid, bis(2,2,6,6-tetramethyl-4-piperidiny) and 1,5-dioxaspiro[5.5]undecane-3,3-dicarboxylic acid, bis(1,2,2,6,6-pentamethyl-4-piperidiny) and mixtures thereof.
8. The composition of claim 2 wherein said hydroxybenzophenone is selected from the group consisting of 2,4-dihydroxybenzophenone, 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-octyloxybenzophenone, 2-hydroxy-4-decyloxybenzophenone, 2-hydroxy-4-dodecyloxybenzophenone, 2-hydroxy-4-benzyloxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, 2,2',4,4'-tetrahydroxybenzophenone, 2,4-dihydroxy-4'-tert-butylbenzophenone; 1,6-bis-(3-hydroxy-4-benzoylphenoxy)hexane; methylenebis-(2-benzoyl-5-methoxyphenol) and mixtures thereof.
9. The composition of claim 2, further comprising a benzotriazole compound.
10. A composition comprising an UV stabilizing composition comprising:
- an ortho-hydroxy tris-aryl-s-triazine compound;

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